

# Space Qualified, Radiation Hardened, Dense Monolithic Flash Memory, Phase I

Completed Technology Project (2010 - 2010)



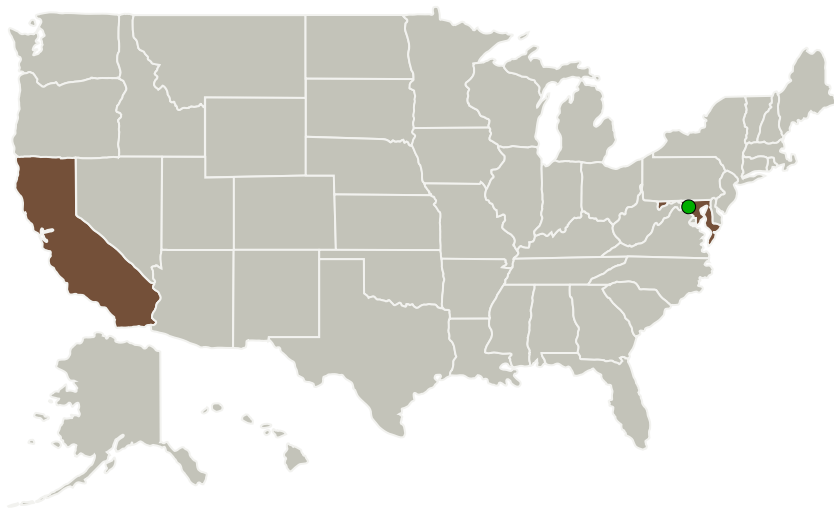
## Project Introduction

Radiation hardened nonvolatile memories for space is still primarily confined to EEPROM. There is high density effective or cost effective NVM solution available to space electronics designers. DoD, NASA, and DTRA R&D investment funding of CRAM, MRAM, and FRAM at the major players (BAE Systems and Honeywell) over the past 10-15 years have not yet resulted in cost effective, high density, producible available space products. Flash memory offers the high density and low price, but the current COTS flash devices are susceptible to Single Event Effects of SEU (Upset) and SEFI (Functional Interrupt and block errors). Bit flips (Upsets) may be tolerable for certain types of data, but if they occur in the processing instructions, functional errors can result in corrupt data at best and lock-up of the Flash circuit at worst. Space Micro is proposing to mitigate SEU and SEFI in space applications by application of patented techniques and leveraging pure commercial IC processes. SEU and its effects of bit and block errors can be effectively corrected with Triple Modular Redundancy (TMR), while SEFI is mitigated with Space Micro patent-pending HF-Core

TM

recovery technology. The end goal is a form-fit-function compatible monolithic IC which is footprint compatible with commercial 4, 8, and future 16-Gb Flash devices.

## Primary U.S. Work Locations and Key Partners



Space Qualified, Radiation Hardened, Dense Monolithic Flash Memory, Phase I

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Organizations Performing Work	Role	Type	Location
Space Micro, Inc.	Lead Organization	Industry	San Diego, California
● Goddard Space Flight Center(GSFC)	Supporting Organization	NASA Center	Greenbelt, Maryland

Primary U.S. Work Locations	
California	Maryland

## Project Transitions

**January 2010:** Project Start**July 2010:** Closed out**Closeout Summary:** Space Qualified, Radiation Hardened, Dense Monolithic Flash Memory, Phase I Project Image**Closeout Documentation:**

- Final Summary Chart Image(<https://techport.nasa.gov/file/140021>)

## Organizational Responsibility

**Responsible Mission Directorate:**

Space Technology Mission Directorate (STMD)

**Lead Organization:**

Space Micro, Inc.

**Responsible Program:**

Small Business Innovation Research/Small Business Tech Transfer

## Project Management

**Program Director:**

Jason L Kessler

**Program Manager:**

Carlos Torrez

**Principal Investigator:**

Dave J Strobel

**Co-Investigator:**

David Strobel

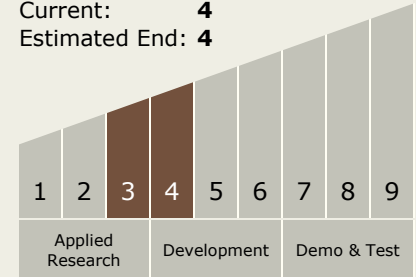
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## Technology Maturity (TRL)

Start: **3**  
Current: **4**  
Estimated End: **4**



## Technology Areas

### Primary:

- TX02 Flight Computing and Avionics
  - └ TX02.1 Avionics Component Technologies
    - └ TX02.1.1 Radiation Hardened Extreme Environment Components and Implementations

## Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System